

Colin D. Paul

National Institutes of Health

National Cancer Institute • Lab of Cell Biology • Tissue Morphodynamics Unit
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EDUCATION AND TRAINING

- 2015-present **Cancer Research Training Postdoctoral Fellow**
National Cancer Institute, National Institutes of Health
Advisor: Kandice Tanner, Ph.D.
- 2010-2015 **Ph.D., Chemical and Biomolecular Engineering**
Institute for NanoBioTechnology Nano-Bio Graduate Training Program
Johns Hopkins University
Advisor: Konstantinos Konstantopoulos, Ph.D.
- 2006-2010 **B.S., Chemical Engineering, B.S., Physics**
University of Arkansas

GRANTS AND SCHOLARSHIPS

- 2017 National Cancer Institute Director's Innovation Award
- 2010-2015 Johns Hopkins University Schwarz Fellowship
- 2011-2014 National Science Foundation Graduate Research Fellowship
- 2006-2010 Honors College Fellowship, University of Arkansas

AWARDS AND HONORS

- 2019 Best Oral Presentation Award, 2019 CCR Fellows and Young Investigators Colloquium
- 2018 Finalist, National Cancer Institute Outstanding Postdoctoral Fellow Award
- 2015 Johns Hopkins Chemical and Biomolecular Engineering Graduate Student Award
- 2013 Biomedical Engineering Society Graduate Design and Research Award
- 2012 Institute for NanoBioTechnology International Research Experience for Students
- 2011 Institute for NanoBioTechnology International Research Experience for Students
- 2010 Phi Beta Kappa, University of Arkansas
- 2010 Sigma Pi Sigma, University of Arkansas
- 2009 1st Place, American Institute of Chemical Engineers Mid-America Regional Undergraduate Student Paper Competition
- 2007 Tau Beta Pi, University of Arkansas

TEACHING AND PROFESSIONAL EXPERIENCE

- 2019 Management in Scientific Organizations course, National Institutes of Health
- 2019 Instructor, National Institutes of Health CCSEP-CSOAR Program
- 2017-present Editor, National Cancer Institute Fellows Editorial Board
- 2018 Scientists Teaching Science course, National Institutes of Health
- 2016-2018 Mentor for summer students, National Cancer Institute

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| 2016 | Grant Writing 101 course, National Institutes of Health |
| 2016 | Responsible Conduct of Research Course, Center for Cancer Training, National Cancer Institute |
| 2013 | Teaching assistant, Johns Hopkins University graduate students, NanoBioTechnology Lab |
| 2012-2015 | Mentor for undergraduate students, Johns Hopkins University |
| 2012-2013 | Teaching assistant, Johns Hopkins University undergraduate students, Transport Phenomena I |
| 2012 | Co-chair, Institute for NanoBioTechnology Fall Symposium, Johns Hopkins University |

INVITED SEMINARS

* indicates presenting author

1. **C.D. Paul***, K. Bishop, A. Devine, E.L. Paine, J.R. Staunton, S.M. Thomas, J. Thomas, L.M. Miller Jenkins, N.Y. Morgan, R. Sood, and K. Tanner. *Differential Extravasation Patterns Drive Organ Targeting of Tumor Cells in Zebrafish*. Oral presentation. CCR Fellows and Young Investigators 2019 Colloquium, National Cancer Institute, Rockville, MD (February 2019).
2. **C.D. Paul***, K. Bishop, A. Devine, E.L. Paine, J.R. Staunton, S.M. Thomas, L.M. Miller Jenkins, N.Y. Morgan, R. Sood, and K. Tanner. *Tissue Architectural Cues and Differential Extravasation Patterns Drive the Non-Random Trafficking of Tumor Cells in Larval Zebrafish*. Oral presentation. CCR Fellows and Young Investigators Association Seminar Series, National Cancer Institute, Frederick, MD (September 2018).

PLATFORM ORAL PRESENTATIONS

* indicates presenting author

1. **C.D. Paul***, K. Bishop, A. Devine, W.J. Wulftange, E.L. Paine, J.R. Staunton, S. Shema, V. Bliskovsky, L.M. Miller Jenkins, N.Y. Morgan, R. Sood, and K. Tanner. *Tissue Architectural Cues and Differential Extravasation Patterns Drive the Non-Random Trafficking of Tumor Cells in Larval Zebrafish*. Oral presentation. American Institute of Chemical Engineers Annual Meeting, Pittsburgh, PA (November 2018).
2. **C.D. Paul***, A. Hruska, J.R. Staunton, H.A. Burr, J. Kim, N. Jiang, and K. Tanner. *Decoupling Cellular Response to Topography and Stiffness in Three Dimensions*. Oral presentation. American Institute of Chemical Engineers Annual Meeting, Pittsburgh, PA (October 2018).
3. **C.D. Paul***, A. Hruska, J.R. Staunton, H.A. Burr, J. Kim, N. Jiang, and K. Tanner. *Decoupling Cellular Response to Topography and Stiffness in Three Dimensions*. Oral presentation. Biomedical Engineering Society Annual Meeting, Atlanta, GA (October 2018).
4. **C.D. Paul***, K. Bishop, A. Devine, N. Morgan, E. Paine, L. Jenkins, R. Sood, and K. Tanner. *In Vivo, Multi-Organ Examination of Cancer Cell Trafficking and Extravasation in Early Metastatic Dissemination*. Oral presentation. Biomedical Engineering Society Annual Meeting, Phoenix, AZ (October 2017).
5. **C.D. Paul***, A. Devine, and K. Tanner. *Tissue-Specific Characterization of Innate and Introduced Immune Cell Migration in *Danio rerio**. Oral presentation. Biomedical Engineering Society Annual Meeting, Phoenix, AZ (October 2017).

6. **C.D. Paul***, A. Devine, K. Bishop, N. Morgan, R. Sood, M. Gottesman, and K. Tanner. *Capillary Arrest and Intravascular Migration in a Zebrafish Model of Early Metastasis*. Oral presentation. Biomedical Engineering Society Annual Meeting, Minneapolis, MN (October 2016).
7. **C.D. Paul***, D.J. Shea, M.R. Mahoney, A. Chai, V. Laney, W.-C. Hung, and K. Konstantopoulos. *The Interplay of the Physical Microenvironment, Contact Guidance, and Cell Signaling in Cell Decision Making*. Oral presentation. Biomedical Engineering Society Annual Meeting, Tampa, FL (October 2015).
8. **C.D. Paul***, E. Mathieu, R. Stahl, G. Vanmeerbeeck, K. Konstantopoulos, and L. Lagae. *Single-Cell Lens-Free Imaging of Cell Migration in Diverse Microenvironments*. Oral presentation. Biomedical Engineering Society Annual Meeting, Tampa, FL (October 2015).
9. **C.D. Paul***, D.J. Shea, M.R. Mahoney, W.-C. Hung, and K. Konstantopoulos. *Dimensionality and Contact Guidance Affect Tumor Cell Migration and Decision Making*. Oral presentation. Biomedical Engineering Society Annual Meeting, San Antonio, TX (October 2014).
10. **C.D. Paul***, P.R. Raman, K.M. Stroka, and K. Konstantopoulos. *A Microfluidic Device to Measure Traction Forces During Confined Chemotactic Migration*. Oral presentation. American Institute of Chemical Engineers Annual Meeting, San Francisco, CA (November 2013).
11. **C.D. Paul***, P.R. Raman, K.M. Stroka, and K. Konstantopoulos. *A Microfluidic Device to Measure Traction Forces During Confined Chemotactic Migration*. Oral presentation. Biomedical Engineering Society Annual Meeting, Seattle, WA (September 2013).
12. **C.D. Paul*** and J.A. Hestekin. *Pervaporative Recovery of Butanol from Fermentation Broth Using Mixed Matrix Membranes*. Invited oral presentation. American Institute of Chemical Engineers Annual Student Conference, Nashville, TN (November 2009).
13. **C.D. Paul**, M.B. O'Neil, W.R. Penney, B.J. Van Wie, P.B. Golter, R.R. Beitle, and E.C. Clausen*. *Desktop learning module heat exchanger performance*. Oral presentation and conference paper. Proceedings of the 2009 Midwest Section Conference of the American Society for Engineering Education, Lincoln, NE (September 2009).
14. **C.D. Paul*** and J.A. Hestekin. *Pervaporative Recovery of Butanol from Fermentation Broth*. Oral presentation. Mid-America Regional American Institute of Chemical Engineers Meeting, Columbia, MO (April 2009).

PATENTS

1. K. Konstantopoulos, **C.D. Paul**, A. Quinones-Hinojosa, and A. Kontrogianni-Konstantopoulos. *Microfluidic chip for analysis of cell motility and methods for using same*. United States Patent 10,105,700, **2018**
2. K. Konstantopoulos, **C.D. Paul**, A. Quinones-Hinojosa, S.R. Shah, A. Ruiz-Valls, C. Yankaskas, J.C. Martinez-Gutierrez, and B.S. Wong. *Use of an integrated microfluidic chip for analysis of cell motility and prediction and prognosis of patient survival*. United States Patent Application Number 15/780,768, **2018**

PUBLICATIONS

1. **C.D. Paul**, K. Bishop, A. Devine, E.L. Paine, J.R. Staunton, S.M. Thomas, J.R. Thomas, A.D. Doyle, L. M. Miller Jenkins, N.Y. Morgan, R. Sood, and K. Tanner. Tissue architectural cues drive organ targeting of tumor cells in zebrafish. **Cell Systems**, in press, **2019**
2. J.R. Staunton, Y.S. Woong, **C.D. Paul**, and K. Tanner. High-frequency microrheology in 3D reveals mismatch between cytoskeletal and extracellular matrix mechanics in cancer cells. **PNAS**, in press, **2019**
3. C.L. Yankaskas, K.N. Thompson, **C.D. Paul**, M.I. Vitolo, P. Mistriotis, A. Mahendra, V.K. Bajpal, D.J. Shea, K.M. Manto, A.C. Chai, N. Varadarajan, A. Kontrogianni-Konstantopoulos, S.S. Martin, and K. Konstantopoulos. A microfluidic assay for the quantification of the metastatic propensity of breast cancer specimens. **Nature Biomedical Engineering** 3: 452-465, **2019**
(see also *United States Patent 10,105,700*)
4. **C.D. Paul**, A. Hruska, J.R. Staunton, H.A. Burr, K.M. Daly, J. Kim, N. Jiang, and K. Tanner. Probing cellular response to topography in three dimensions. **Biomaterials** 197: 101-118, **2019**
5. **C.D. Paul***, A. Devine*, K. Bishop, Q. Xu, W.J. Wulfange, H. Burr, K.M. Daly, C. Lewis, D.S. Green, J.R. Staunton, S. Choksi, Z.-G. Liu, R. Sood, and K. Tanner. Human macrophages survive and adopt activated genotypes in living zebrafish. **Nature Scientific Reports** 9: 1759, **2019**
*These authors contributed equally
6. **C.D. Paul**, P. Mistriotis, and K. Konstantopoulos. Cancer cell motility: lessons from migration in confined spaces. **Nature Reviews Cancer** 17: 131-140, **2017**
7. M. Shriver, S. Marimuthu, **C. Paul**, J. Geist, K. Konstantopoulos, and A. Kontrogianni-Konstantopoulos. Giant obscurins regulate the PI3K cascade in breast epithelial cells via direct binding to the PI3K/p85 regulatory subunit. **Oncotarget** 7: 45414-45428, **2016**
8. E. Mathieu*, **C.D. Paul***, R. Stahl, G. Vanmeerbeeck, V. Reumers, C. Liu, K. Konstantopoulos, and L. Lagae. Lens-free imaging of cell migration in diverse physical microenvironments. **Lab on a Chip** 165: 3304-3316, **2016**
*These authors contributed equally
9. **C.D. Paul**, W.-C. Hung, D. Wirtz, and K. Konstantopoulos. Engineered models of confined cell migration. **Annual Review of Biomedical Engineering** 18: 159-180, **2016**
10. **C.D. Paul**, D.J. Shea, M.R. Mahoney, A. Chai, V. Laney, W.-C. Hung, and K. Konstantopoulos. Interplay of the physical microenvironment, contact guidance, and intracellular signaling in cell decision making. **The FASEB Journal** 30: 2161-2170, **2016**
11. P. Wang, S.-H. Chen, W.-C. Hung, **C. Paul**, F. Zhu, P.-P. Guan, D.L. Huso, A. Kontrogianni-Konstantopoulos, and K. Konstantopoulos. Fluid shear promotes chondrosarcoma cell invasion by activating matrix metalloproteinase-12 via IGF-2 and VEGF signaling pathways. **Oncogene** 34: 4558-4569, **2014**
12. P.S. Raman*, **C.D. Paul***, K.M. Stroka, and K. Konstantopoulos. Probing cell traction forces in confinement microenvironments. **Lab on a Chip** 13: 4599-4607, **2013**
*These authors contributed equally

13. W.-C. Hung, S.-H. Chen, **C.D. Paul**, K.M. Stroka, Y.-C. Lo, J.T. Yang, and K. Konstantopoulos. Distinct signaling mechanisms regulate migration in unconfined versus confined spaces. **Journal of Cell Biology** 202(5): 807-824, **2013**
14. S.-H. Chen, W.-C. Hung, P. Wang, **C. Paul**, and K. Konstantopoulos. Mesothelin binding to CA125/MUC16 promotes pancreatic cancer cell motility and invasion via MMP-7 activation. **Nature Scientific Reports** 3: 1870, **2013**
15. E.M. Balzer, Z. Tong, **C.D. Paul**, W.-C. Hung, K.M. Stroka, A.E. Boggs, S.S. Martin, and K. Konstantopoulos. Physical confinement alters cell adhesion and migration phenotypes. *The FASEB Journal* 26(10): 4045-4056, **2012**